Practitioner's Docket No. 540-004.003

CHAPTER II

Preliminary Classification:
Proposed Class:
Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P., § 601, 7th ed.

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/FI00/00503	6 June 2000	7 June 1999
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

Method for the Preparation of Nickel Concentrate
TITLE OF INVENTION

Esko HANNINEN, Jaakko LEPPINEN and Vaino HINTIKKA
APPLICANT(S)

Box PCT
Assistant Commissioner for Patents
~~Washington, D.C. 20231~~ U.S. Patent and Trademark Office, PO Box 2327, Arlington, VA 22202
ATTENTION: EO/US

CERTIFICATION UNDER 37 C.F.R. § 1.10*
*(Express Mail label number is **mandatory**.)*
(Express Mail certification is optional.)

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date December 5, 2001 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EV005523525, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Judith Schick
(type or print name of person mailing paper)

Judith Schick
Signature of person mailing paper

***WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

***WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

NOTE: *To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.*

WARNING: *Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.*

NOTE: *Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).*

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

a. [X] This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).

b. [X] The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☐*	TOTAL CLAIMS 10	-20=		× $18.00=	$ 0
	INDEPENDENT CLAIMS 1	-3=		× 84.00	0
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ 280.00	
BASIC FEE**	☐ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☐ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 C.F.R. § 1.492(a)(4)) ..... 100 ☐ and the above requirements are not met (37 C.F.R § 1.492(a)(1)) ..... 710 ☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☐ has been paid (37 C.F.R. § 1.492(a)(2)) ..... 740 ☒ has not been paid (37 C.F.R. § 1.492(a)(3)) ..... 1040 ☐ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. § 1.492(a)(5)) 890				
	Total of above Calculations				= $1040.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 C.F.R. § 1.9, 1.27, 1.28)				-
	Subtotal				$1040.00
	Total National Fee				$ 1040.00
	Fee for recording the enclosed assignment document $40.00 (37 C.F.R. § 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				$ 1040.00

*See attached Preliminary Amendment Reducing the Number of Claims.

i. ☒ A check in the amount of $1040 to cover the above fees is enclosed.

ii. ☐ Please charge Account No. _____ in the amount of $ _____. A duplicate copy of this sheet is enclosed.

**WARNING: *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

a. ☐ is transmitted herewith.

b. ☐ is not required, as the application was filed with the United States Receiving Office.

c. ☒ has been transmitted

i. ☒ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308): 14 Dec. 2000

ii. ☐ by applicant on _____.
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on _____.
Date

d. ☐ will follow.

5. ☐ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

a. ☐ are transmitted herewith.

b. ☐ have been transmitted

i. ☐ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): _____.

ii. ☐ by applicant on (date) _____.
Date

c. ☐ have not been transmitted as

i. ☐ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210.): _____.

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☐ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☐ is not required as the amendments were made in the English language.

c. ☐ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☒ is transmitted herewith.

☐ is not required as the application was filed with the United States Receiving Office.

8. ☒ Annex(es) to the international preliminary examination report

a. ☒ is/are transmitted herewith.

b. ☐ is/are not required as the application was filed with the United States Receiving Office.

9. ☒ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☒ is not required as the annexes are in the English language.

10. [X] An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

a. [ ] was previously submitted by applicant on __________.
Date

b. [ ] is submitted herewith, and such oath or declaration

i. [ ] is attached to the application.

ii. [ ] identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.

c. [X] will follow.

II. Other document(s) or information included:

11. [X] An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

a. [ ] is transmitted herewith.

b. [X] has been transmitted by the International Bureau.
Date of mailing (from form PCT/IB/308): 14 Dec. 2000

c. [ ] is not required, as the application was searched by the United States International Searching Authority.

d. [ ] will be transmitted promptly upon request.

e. [ ] has been submitted by applicant on __________.
Date

12. [X] An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

a. [X] is transmitted herewith.

Also transmitted herewith is/are:

[X] Form PTO-1449 (PTO/SB/08A and 08B).

[X] Copies of citations listed.

b. [ ] will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).

c. [ ] was previously submitted by applicant on __________.
Date

13. [ ] An assignment document is transmitted herewith for recording.

A separate [ ] "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or [ ] FORM PTO 1595 is also attached.

____

____

____

14. ☐ Additional documents:

a. ☐ Copy of request (PCT/RO/101)

b. ☒ International Publication No. WO 00/74856

i. ☒ Specification, claims and drawing

ii. ☐ Front page only

c. ☒ Preliminary amendment (37 C.F.R. § 1.121)

d. ☐ Other

_____

_____

_____

15. ☒ The above checked items are being transmitted

a. ☒ before 30 months from any claimed priority date.

b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

_____

_____

_____

_____

_____

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 23-0442

☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☐ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☐ 37 C.F.R. § 1.17 (application processing fees)

☐ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☐ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

SIGNATURE OF PRACTITIONER

Reg. No.: 27,550

Tel. No.: (203) 261-1234

Customer No.: 004955

Alfred A. Fressola
(type or print name of practitioner)
Ware, Fressola, Van Der Sluys & Adolphson LLP
755 Main Street, Building Five
P.O. Address
PO Box 224
Monroe, CT 06468

PATENT
540-004.3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the matter of: Hanninen et al)
)
Serial No:) Group Art Unit
) Examiner:
Filed: Herewith)
)
PCT International No. PCT/FI00/00503)
)
International Filing Date: June 6, 2000)
)
For: Method of the Preparation of Nickel Concentrate)

ASSISTANT COMMISSIONER OF PATENTS
U.S. Patent and Trademark Office
P.O. Box 2327
Arlington, VA 22202

PRELIMINARY AMENDMENT

Sir:

Please preliminarily amend the above-referenced application as follows:

In the Specification:

On page 1, prior to line 4, please insert a new heading as follows:

--Technical Field--.

On page 1, prior to line 6, please insert a new heading as follows:

--Background of the Invention--.

Express Mail No. EV005523525US

Please replace the paragraph beginning at page 2, line 1, with the following rewritten paragraph:

--Summary of the Invention:

A method for preparing a nickel concentrate from pyrrhotite-pentlandite ore, wherein the following steps are performed: comminuting the ore to the maximum grain size at which the major portion of the sulphide minerals is liberated from silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, the maximum grain size being preferably in the range 100% - 10 mm...100% - 0.5 mm; separating by magnetic means from the comminuted ore the particles containing pyrrhotite as a magnetic concentrate (M1), the resulting residue being a non-magnetic product (EM1); if desired, additional grinding of the magnetic concentrate (M1) and separating the pyrrhotite from the refuse minerals and precious sulphides by means of additional separation; and delivering the non-magnetic products (EM1, EM2) obtained as a residue after the magnetic separation to flotation, where nickel and/or other precious sulphide concentrates are produced.--

On page 2, prior to line 16, please insert a new heading and paragraph as follows:

--Brief Description of the Drawings

The figure is a flow diagram of the method of preparing nickel concentrates according to the present invention.--

In the Claims:

Claims 1 and 3 - 6 have been amended as follows:

1. (Amended) A method for preparing a nickel concentrate from pyrrhotite-pentlandite ore, characterised in that the following steps are performed:

• comminuting the ore to the maximum grain size at which the major portion of the sulphide minerals is liberated from silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, the maximum grain size being preferably in the range 100% - 10 mm...100% - 0.5 mm;

• separating by magnetic means from the comminuted ore the particles containing pyrrhotite as a magnetic concentrate (M1), the resulting residue being a non-magnetic product (EM1):

• if desired, additional grinding of the magnetic concentrate (M1) and separating the pyrrhotite from the refuse minerals and precious sulphides by means of additional separation; and

• delivering the non-magnetic products (EM1, EM2) obtained as a residue after the magnetic separation to flotation, where nickel and/or other precious sulphide concentrates are produced.

3. (Amended) A method as defined in claim 2, in which the magnetic concentrate (M1) is additionally ground, and during the additional grinding fine material such as material under 0.1 to 0.2 mm is removed.

4. (Amended) A method as defined in claim 3, in which rough concentration is first carried out during the flotation by means of rough flotation techniques.

5. (Amended) A method as defined in claim 4, in which the flotation is carried out repeatedly and in which the coarse end of the repeatedly prepared refuse is returned to intermediate grinding.

6. (Amended) A method as defined in claim 5, in which nickel is recovered from the magnetic fine crushed product by means of dissolution.

Claims 7 - 10 have been added as follows.

7. A method as defined in claim 1, in which the magnetic concentrate (M1) is additionally ground, and during the additional grinding fine material such as material under 0.1 to 0.2 mm is removed.

8. A method as defined in claim 1, in which rough concentration is first carried out during the flotation by means of rough flotation techniques.

9. A method as defined in claim 1, in which the flotation is carried out repeatedly and in which the coarse end of the repeatedly prepared refuse is returned to intermediate grinding.

10. A method as defined in claim 1, in which nickel is recovered from the magnetic fine crushed product by means of dissolution.

In the Abstract:

After claim page 11, please add:

--Abstract of the Disclosure

The invention relates to a method for preparing nickel concentrate from pyrrhotitepentlandite ore. The method comprises grinding the ore to the maximum grain size at which the major portion of the sulphide minerals is worked off from the silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, and separating the particles containing pyrrhotite magnetically from the ground ore to form a magnetic concentrate (MI). The non-magnetic products (EM1, EM2) obtained as a residue after magnetic separation are delivered to flotation, where the nickel and;or other precious sulphide concentrates are produced.--

Remarks

Claims 1, and 3 - 6 have been amended and claims 7 - 10 have been added. This preliminary amendment has been filed for the purpose of placing the application into standard U.S. format and to eliminate multiple dependent claims. Consideration and allowance of the claims is earnestly solicited.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**<u>Version with markings to show changes made</u>**".

Respectfully submitted,

Date: 5 Jan 2001

Alfred A. Fressola, Reg. No. 27,550
Ware, Fressola, Van Der Sluys
& Adolphson LLP
Bradford Green, Building Five
755 Main Street, PO Box 224
Monroe, CT 06468
(203) 261-1234

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

Paragraph beginning at page 2, line 1 has been amended as follows:

[General description of the invention

The method for preparing nickel concentrates as defined in claim 1 has now been found. The other claims define a number of aspects of useful application of the invention.]

Summary of the Invention:

A method for preparing a nickel concentrate from pyrrhotite-pentlandite ore, wherein the following steps are performed: comminuting the ore to the maximum grain size at which the major portion of the sulphide minerals is liberated from silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, the maximum grain size being preferably in the range 100% - 10 mm...100% - 0.5 mm; separating by magnetic means from the comminuted ore the particles containing pyrrhotite as a magnetic concentrate (M1), the resulting residue being a non-magnetic product (EM1); if desired, additional grinding of the magnetic concentrate (M1) and separating the pyrrhotite from the refuse minerals and precious sulphides by means of additional separation; and delivering the non-magnetic products (EM1, EM2) obtained as a residue after the magnetic separation to flotation, where nickel and/or other precious sulphide concentrates are produced.

In the Claims:

1. (Amended) A method for preparing a nickel concentrate from pyrrhotite-pentlandite ore, characterised in that the following steps are performed:

• comminuting the ore to the maximum grain size at which the major portion of the sulphide minerals is liberated from silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, the maximum grain size being preferably in the range 100% - 10 mm...100% - 0.5 mm[,] ;

• separating by magnetic means from the comminuted ore the particles containing pyrrhotite as a magnetic concentrate (M1), the resulting residue being a non-magnetic product (EM1)[,] ;

• if desired, additional grinding of the magnetic concentrate (M1) and separating the pyrrhotite from the refuse minerals and precious sulphides by means of additional separation[,]; and

• delivering the non-magnetic products (EM1, EM2) obtained as a residue after the magnetic separation to flotation, where nickel and/or other precious sulphide concentrates are produced.

3. (Amended) A method as defined in claim [1 or] 2, in which the magnetic concentrate (M1) is additionally ground, and during the additional grinding fine material such as material under 0.1 to 0.2 mm is removed.

4. (Amended) A method as defined in [any of claims 1 to] claim 3, in which rough concentration is first carried out during the flotation by means of rough flotation techniques.

5. (Amended) A method as defined in [any of claims 1 to] claim 4, in which the flotation is carried out repeatedly and in which the coarse end of the repeatedly prepared refuse is returned to intermediate grinding.

6. (Amended) A method as defined in [any of claims 1 to] claim 5, in which nickel is recovered from the magnetic fine crushed product by means of dissolution.

Method for the preparation of nickel concentrate

Introduction

The invention relates to mineral concentrating technology and concerns a method for preparing nickel concentrates (= a process for concentrating nickel ores).

The major part of the global nickel production is derived from pyrrhotite-pentlandite-copper pyrite ore of magmatic origin, in which the quantitatively predominating minerals are silicates and pyrrhotite. The amounts of precious sulphides, pentlandite and pyrrhotite, are smaller, accounting only for a few per cent. The following methods have been conventionally implemented in the concentration of these minerals:

- crushing and grinding the material to flotation fineness, the different precious mineral particles being principally discrete grains (with a high degree of liberation at this early stage). This is followed by flotation of the conjugate sulphide concentrate (Ni content in the range of 4 to 6%). Before the nickel flotation, the Cu concentrate has occasionally been separated from the ores that are richest in copper.

- Increasing the Ni content of the concentrate (to a level in the range of 6 to 10%) and decreasing the amount by pressing pyrrhotite into the residue during flotation. The yield losses have prevented quantitative pyrrhotite pressing, because the difference found between pentlandite and pyrrhotite has not been sufficient for selective separation to be successful.

- Performing magnetic separation of pyrrhotite from the products in various process steps (feed material, rough concentrate, concentrate), usually from a material ground to flotation fineness. However, this has only yielded a partial solution, because pyrrhotite with this fineness will not be removed in its totality by magnetic means. The different pyrrhotite phases, monoclinic/ferromagnetic and hexagonal/-paramagnetic, are separated at this degree of fineness. On the other hand, in very fine grain size groups, magnetic separation is not sufficiently selective, and fine precious minerals will be present in the magnetic fraction. The losses of nickel yield have been so great that even magnetic separation has not become a commonly implemented method of producing high-quality nickel concentrates.

General description of the invention

The method for preparing nickel concentrates as defined in claim 1 has now been found. The other claims define a number of aspects of useful application of the invention.

The method may comprise the following steps:

1. Selective gradual comminution of the minerals in different process steps

2. Pyrrhotite separation by magnetic means

3. Rough flotation and removal of coarse fraction

4. Flotation

5. Dissolution of pyrrhotite concentrate and precipitation of precious metals

Compared with conventional nickel concentration, the method provides a preparation concentrate with higher nickel content and higher yield of precious minerals at lower investment and operating costs. The enhanced quality of the concentrate will also have an appreciable economic and ecologic impact on the further refining chain of the concentrates.

Detailed description of the invention

The new method is based on the utilisation of natural selective desintegration of the minerals to be prepared by using old, approved means of concentration, classification, magnetic separation and flotation aiming at high-quality nickel (and copper) concentrates with optimal yields of precious metals. The grinding of the invention and the choice and new combination of concentrating methods are based on the observed occurrence of precious minerals in the ore to be utilised:

- In this particular type of ore, sulphides occur in agglomerations in the interspaces between silicates having usually a notably greater crystal size than these. Pentlandite always occurs and copper pyrite nearly always occurs within or at the side of pyrrhotite.

- The major part of pentlandite (70 to 80%) occurs as idiomorphic crystals (∅ 0.3-20 mm), which are internally splintered (∅ 0.01-0.3 mm). An originally intact pentlandite crystal most frequently is splintered into dozens of fragments in its original position in pyrrhotite. A small portion of pentlandite (5-10%) form small-

crystal (under ∅ 0.1 mm) grain sequences on the interfaces between the pyrrhotite crystals and a small portion (5%) occur as filtering flames (under ∅ 0.02 mm) in the pyrrhotite.

• In most ores, pyrrhotite is a mixture of the monoclinic (ferromagnetic) and hexagonal (paramagnetic) phases. The mineral contains an average of 0.3 to 0.4% of nickel (so-called grid nickel) as an iron substitute.

Based on the mineralogical matters presented above and supported by the preliminary indicative test results given below, the following process is proposed for the production of high-quality nickel concentrates:

1. Selective mineral comminution

Fine crushing or coarse grinding

The purpose of comminution is to liberate sulphides from silicates and to grind the precious minerals pentlandite and pyrrhotite to flotation fineness at as early a stage as possible in order to minimise over-grinding. Liberating sulphides from silicates does not require the silicates to be ground under their crystal size. In the tests conducted with exemplifying ore, a degree of fineness of 100% - 4 mm in this comminuting step was enough. The choice of communitor may consist of the most efficient, economical device which performs optimal grinding following the grain limits (coarse, harder silicate/softer sulphide) such that the soft sulphide fraction is crushed (the pentlandite splinters are liberated from pyrrhotite and pyrrhotite is liberated from silicates as far as possible), but the silicate crystals are not necessarily reduced to a notable degree. A significant portion of pentlandite and pyrrhotite is liberated to flotation fineness already in this comminuting step.

Grinding of a highly magnetic product

The magnetic product of high-magnetic separation should contain all the grains containing pyrrhotite even in small amounts. In that case, all the unliberated pentlandite and the major portion of unliberated copper pyrite would end up in this product. The fine and coarse material of the magnetic product is separated into different groups. Depending on the type of ore, the classification limit is in the range ∅ 0.1 to 0.3 mm. The coarse fraction is led to further grinding in order to crush mixed grains and to liberate precious minerals.

Grinding of repeatedly prepared residue in the flotation circuit

Considering the coarseness of the material fed into the flotation circuit, coarse mixed grains which are unfit for use in the final concentrate may naturally cumulate in the repeatedly prepared residue, and these grains can be easily disintegrated with light additional grinding and the product can be returned to a suitable point of the flotation circuit.

2. Magnetic separation

High-magnetic separation

Primary magnetic separation is carried out from fine metal/coarse powder, all the grains containing pyrrhotite being separated to the magnetic product. The separator should have adequate field intensity for each individual case. Lower field intensity will be enough for monoclinic pyrrhotite, whereas hexagonal pyrrhotite requires considerably stronger field intensity in order to separate into the magnetic product. From the magnetic product of high-magnetic separation, a fine, pure pyrrhotite and a coarse pyrrhotite with mixed grains are separated by classification, the latter being further ground.

Low-magnetic separation

The separation is performed with a separator, which separates only pure pyrrhotite into the magnetic product. This yields a product with a nickel content of the usual order of 0.8 to 1.0% (containing the grid nickel in the pyrrhotite and a small amount of pentlandite particles, which are mainly small xenoliths within the pyrrhotite). The nickel yield in the magnetic product is accordingly of the order of 10-15%. The magnetic separation residue (= a non-magnetic product containing silicates, pentlandite and pyrrhotite) has a small volume and contains precious sulphides in a significant amount. It is conducted to the flotation circuit along with the primary separation residue.

3. Rough flotation and removal of the coarse silicate fraction

The high-magnetic separation residue (the major portion of the feed material) is classified using as a classification limit the maximum grain size in which precious sulphides are still quantitatively flotated (e.g. ∅ 0.25 mm) in a conventional flotation +process). From the fraction below classification, precious sulphides are flotated with rough-flotation techniques and the concentrate is fed into the suitable

process step of the actual flotation circuit according to the product quality. The flotation residue is a coarse silicate material, which is either taken to a dump or reclaimed.

4. Flotation

In flotation, precious sulphides are separated from silicates as a separate concentrate (Ni-Cu conjugate concentrate) or separate concentrates (Ni and Cu concentrates) in normal sulphide flotation conditions. The flotation aims at separating pentlandite and copper pyrite from silicates and any other sulphides present, such as hexagonal pyrrhotite and pyrite. The repeated preparation of rough concentrate focuses on silicate removal using conventional techniques. The coarse end of repeatedly prepared residues can be returned to intermediate grinding and from there to flotation, where the mixed grains would produce a cumulative circulating load on the repetitive circuit and would also entail losses of yield if no intermediate grinding were performed.

5. Dissolution

Pyrrhotite removal causes yield losses of approx. 10 to 20% regarding nickel. The pyrrhotite fraction usually has a nickel content of 0.8 to 1.5%, preferably 0.8 to 1.0%. If desired, the nickel contained in this product can be further recovered by dissolution, for instance atmospheric oxygen dissolution, oxygenating pressure dissolution or bacterial dissolution methods. Precious minerals are precipitated from the solution with a suitable method, resulting in a deposit (or deposits in the case of selective precipitation), which can be further refined jointly with the concentrates, for instance.

Benefits gained by the method

Estimated on the results of preliminary batch tests on laboratory scale, the method yields a 20% nickel content in the concentrate, the Ni yield being at the level of 70 to 75%. In addition, the nickel contained in the pyrrhotite can be utilised by dissolution, so that the overall yield loss will be of the order of 10 to 15% or less. The concentrate amounts are notably smaller than those produced with conventional methods.

The process control is simpler than at conventional nickel concentrating plants, because the mass flows in the flotation circuit are notably smaller owing to the

pyrrhotite and silicate removal. The products to be further ground have a small mass and relatively homogenous quality, thus allowing better process control.

This method also allows the elimination of the typical problem of many nickel ores, which is caused by fine grinding in the presence of silicates, given that the method of the invention removes a major portion of the silicates from the process in a notably coarser form than in conventional processes. The conventional simultaneous fine grinding of the total material produces over ground (colloidal) mineral material (sludge) which has a negative effect on the flotation and the quality of the products, and also calls for a more complex flotation circuit and increased chemical consumption (i.e. higher production costs).

The investment and operating costs of concentrating plants will diminish with the method of the invention i.a. for the following reasons:

- Minimised comminuting apparatus and use of grinding energy,

- Smaller-sized apparatus and reduced use of the flotation circuit compared to conventional flotation circuits

- A decrease in the concentrate amount, resulting in reduced processing costs (filtering, drying etc.).

The higher concentrate quality and smaller concentrate amount has a significant bearing on the further refining chain:

- Lower freight charges

- Lower smelting plant costs

- Smaller amount of sulphur to be recovered from flue gases

The enclosed figure is an exemplifying flow diagram of a process in accordance with the invention.

Exemplifying tests conducted with the method of the invention

An ore sample was crushed with a jaw crusher and was further comminuted with a roll crusher during gradual screening to a grain size of -1.4 mm. No screen analysis was performed. The screen analysis of the products of the further process allows the conclusion that approx. 60% of the material was under 0.25 mm (approx. 90% of

pentlandite and approx. 85% of copper pyrite). The - 0.032 mm fraction accounted for 20% of the total amount of crushed product.

The pyrrhotite was removed with a drum separator equipped with high-magnetic neorem magnets (magnet field intensity of approx. 0.1 T in the separation duct and of 0.3 T on the drum surface) in wet separation. The removal of pyrrhotite was almost totally successful. The calculatory loss to the non-magnetic product was 2.9%.

Using classification (0.125 mm mesh) of the magnetic product of high-magnetic separation, the coarse grains containing pyrrhotite were separated for further grinding from the fine pyrrhotite, which was already free from precious minerals (with the exception of pentlandite filtering products). The purpose of further grinding of the coarse product was to liberate the pentlandite and copper pyrite grains accompanying the pyrrhotite particles. After this magnetic repeated preparation was performed with the ground product using a SALA low-magnetic wet separator.

The fine pyrrhotite, which was almost free of precious minerals, was removed as a separate product (pyrrhotite concentrate). The apparatus was a SALA low-magnetic wet drum separator. The test was conducted by subjecting the magnetic product to an additional iterative separation (purification) with the same separator.

The pyrrhotite concentrate from the preceding test had

- A pyrrhotite content of 99%
- A nickel content of 0.88%
- A pyrrhotite yield of 91%
- A nickel yield of 14%
- A copper yield of 7%
- A yield of granular pentlandite of 3%

Flotation was performed with the combined non-magnetic products of the magnetic separation. During the flotation, pentlandite and pyrrhotite were concentrated while the silicates were left in the residue (partly even in quite a coarse form). The

flotation residue also comprised the pyrrhotite (of which a small amount was hexagonal and had been subjected to magnetic separation) and pyrite.

Preliminary flotation, in which the pH conditions were controlled with sulphuric acid (H_2SO_4) to a value of 6.5 of the natural ore value (9.0). The acid consumption was 0.57 kg/t of material feed. 300 g/t of NaIBX (sodium isobutyl xanthate) and 60 g/t of frothing agent (Dow froth 250) were added to the preliminary flotation. The result was:

- A concentrate with a nickel content of 8.1% and a copper content of 2.4%
- A sulphide content of 41%
- Yields: 78.2% of nickel, 82.9% of copper, 88% of pentlandite
- Nickel losses in the residue: +0.25 mm 4.1%, 0.032-0.25 mm 1.5%-0. 032 mm 2.4%

The rough concentrate was subjected to two iterative preparations, with additions of 100 g/t of CMC and 50 g/t of NaIBX to the first one. In this iterative flotation, the pH range was 8.3 to 8.2. 170 g/t of soda (Na_2CO_3) was added to the second iterative flotation, whereby the pH value of the sludge rose to 10.0. In addition, 50 g/t of CMC and 75 g/t of NaIBX were batched in this step. In both the iterative preparations, the preparation periods were 5 minutes for CMC and 2 minutes for NaIBX. Thus a concentrate that had been prepared twice was obtained, whose main properties were:

- A concentrate with a nickel content of 14.5% and a copper content of 4.3%
- A sulphide content of 74%
- Yields: 72.9% of nickel, 77.5% of copper, 82.1% of pentlandite

The enclosed table shows the test analyses, mineral contents and yields.

An ulterior test achieved a Ni content of 20.3% of the concentrate with 1% Ni ore and one single iterative flotation. This test differed from the first test mainly in that the flotation feed material was rich in Ni, with a double Ni content compared to the preceding one (1.48% of Ni/0.65% of Ni). The content ratio of the original ore samples was accordingly 1.0% of Ni/0.67% of Ni. A further difference was the pH value of the rough flotation, i.e. in the range from 9.0 to 8.4 in the latter test; the pH

regulating agent was $Ca(OH)_2$ and the sulphide collector used in the preliminary flotation was potassium butyl xanthate KBX (100 g/t), instead of NaIBX as in the preceding test. The collecting chemicals are practically the same, so that the different results were chiefly brought about by the slightly richer ore and the more advantageous flotating conditions (the other sulphides were not flotated in the concentrate due to the higher pH value and the smaller collecting chemical batching). Thus the better result mentioned above was achieved.

Analyses, mineral contents, yields

Product	Screen class mm	Weight %	Analyses Ni	Cu	S	Mineral contents NIP*	CUK	FEK	SK	OTHERS	Yields Ni	NIP	CUK	FEK	OTHERS	Yields in the circuit NIP	CUK	FEK
Feed material	Bulk	100.0	0.635	0.177	5.12	1.64	0.51	10.8	0.1	87.0	100.0	100.0	100.0	100.0	100.0			
MR	Bulk	9.99	0.878	0.119	39.90	0.54	0.34	99.0		0.1	13.8	3.3	6.7	91.3	0.0			
ES	Bulk	90.02	0.608	0.184	1.26	1.77	0.53	1.0	0.2	96.7	86.2	96.8	93.3	8.0	100.1			
ER	Bulk	6.11	8.125	2.377	15.44	23.68	6.86	10.3	2.1	59.1	78.2	88.0	82.0	5.8				
Rough flot.	0.500-1.000	18.81	0.070	0.050	0.38	0.20	0.14	0.5	0.1	99.0	2.1	2.2	5.3	0.9	21.4			
residue	0.250-0.500	18.35	0.070	0.030	0.22	0.20	0.09	0.2	0.0	99.4	2.0	2.2	3.1	0.4	21.0			
	0.125-0.250	10.98	0.030	0.010	0.10	0.09	0.03	0.1	0.0	99.7	0.5	0.6	0.6	0.1	12.6	90.9	87.9	72.6
	0.063-0.125	11.13	0.030	0.009	0.09	0.09	0.03	0.1	0.0	99.8	0.5	0.6	0.6	0.1	12.8			
	0.032-0.063	9.67	0.030	0.010	0.09	0.09	0.03	0.1	0.0	99.8	0.5	0.5	0.5	0.1	11.1			
	-0.032	14.97	0.101	0.014	0.34	0.29	0.04	0.5	0.1	99.1	2.4	2.6	1.2	0.6	17.1			
	Bulk	83.91	0.060	0.024	0.229	0.17	0.07	0.4	0.0	99.4	8.0	8.7	11.3	2.9	95.8			
KR1	Bulk	3.88	12.45	3.66	23.27	36.30	10.56	15.0	3.0	35.1	76.1	85.7	80.1	5.4	1.6	97.3	97.7	92.3
KJ1	+0.125	0.41	1.300	0.286	3.26	3.75	0.83	3.4	0.7	91.3	0.8	0.9	0.7	0.1	0.4			
KJ1	-0.125	1.82	0.451	0.120	1.50	1.29	0.35	1.9	0.4	96.1	1.3	1.4	1.2	0.3	2.0			
	Bulk	2.23	0.607	0.151	1.82	1.74	0.43	2.2	0.4	95.2	2.1	2.4	1.9	0.4	2.4			
KR2	+0.125	0.90	11.800	3.000	21.40	34.42	8.66	13.8	2.8	40.3	16.7	18.8	15.2	1.2	0.4			
	-0.125	2.30	15.500	4.800	28.60	45.23	13.86	17.4	3.5	20.0	56.2	63.3	62.3	3.7	0.5			
	Bulk	3.20	14.46	4.29	26.58	42.19	12.40	16.4	3.3	25.7	72.9	82.1	77.5	4.9	0.9	95.9	96.8	90.3
KJ2	Bulk	0.68	2.970	0.659	7.69	8.56	1.90	8.3	1.7	79.6	3.2	3.5	2.5	0.5	0.6			

NIP*= granular pentlandite Pyrrhotite Ni=0.7 % contains grid nickel – 0.4 % - and the nickel contained in the estimated pentlandite filtrates

Claims

1. A method for preparing a nickel concentrate from pyrrhotite-pentlandite ore, characterised in that the following steps are performed:

- comminuting the ore to the maximum grain size at which the major portion of the sulphide minerals is liberated from silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, the maximum grain size being preferably in the range 100% - 10 mm...100% - 0.5 mm,

- separating by magnetic means from the comminuted ore the particles containing pyrrhotite as a magnetic concentrate (M1), the resulting residue being a non-magnetic product (EM1),

- if desired, additional grinding of the magnetic concentrate (M1) and separating the pyrrhotite from the refuse minerals and precious sulphides by means of additional separation,

- delivering the non-magnetic products (EM1, EM2) obtained as a residue after the magnetic separation to flotation, where nickel and/or other precious sulphide concentrates are produced.

2. A method as defined in claim 1, in which coarse material is removed from the non-magnetic products (EM1, EM2) before flotation.

3. A method as defined in claim 1 or 2, in which the magnetic concentrate (M1) is additionally ground, and during the additional grinding fine material such as material under 0.1 to 0.2 mm is removed.

4. A method as defined in any of claims 1 to 3, in which rough concentration is first carried out during the flotation by means of rough flotation techniques.

5. A method as defined in any of claims 1 to 4, in which the flotation is carried out repeatedly and in which the coarse end of the repeatedly prepared refuse is returned to intermediate grinding.

6. A method as defined in any of claims 1 to 5, in which nickel is recovered from the magnetic fine crushed product by means of dissolution.

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(71) Applicant *(for all designated States except US)*: VALTION TEKNILLINEN TUTKIMUSKESKUS [FI/FI]; Vuorimiehentie 5, FIN-02044 VTT (FI).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: HÄNNINEN, Esko [FI/FI]; Suorannantie 5, FIN-82500 Kitee (FI). LEPPINEN, Jaakko [FI/FI]; Poikkikatu 11, FIN-83500 Outokumpu (FI). HINTIKKA, Väinö [FI/FI]; Kupariperä 6, FIN-83500 Outokumpu (FI).

(74) Agent: BERGGREN OY AB; P.O. Box 16, FIN-00101 Helsinki (FI).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

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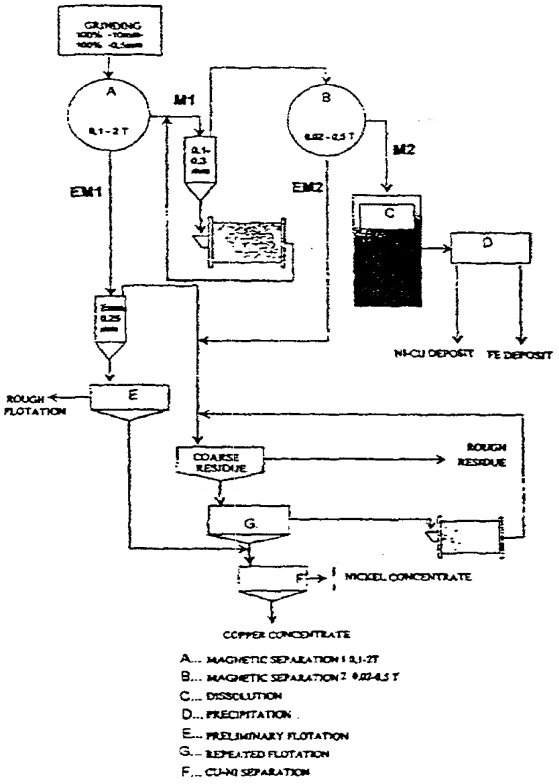
[Continued on next page]

(54) Title: METHOD FOR THE PREPARATION OF NICKEL CONCENTRATE



(57) Abstract: The invention relates to a method for preparing nickel concentrate from pyrrhotitepentlandite ore. The method comprises grinding the ore to the maximum grain size at which the major portion of the sulphide minerals is worked off from the silicate and other refuse minerals and the liberated precious sulphides can be concentrated to high-quality end products directly or by means of additional grinding, and separating the particles containing pyrrhotite magnetically from the ground ore to form a magnetic concentrate (M1). The non-magnetic products (EM1, EM2) obtained as a residue after magnetic separation are delivered to flotation, where the nickel and/or other precious sulphide concentrates are produced.

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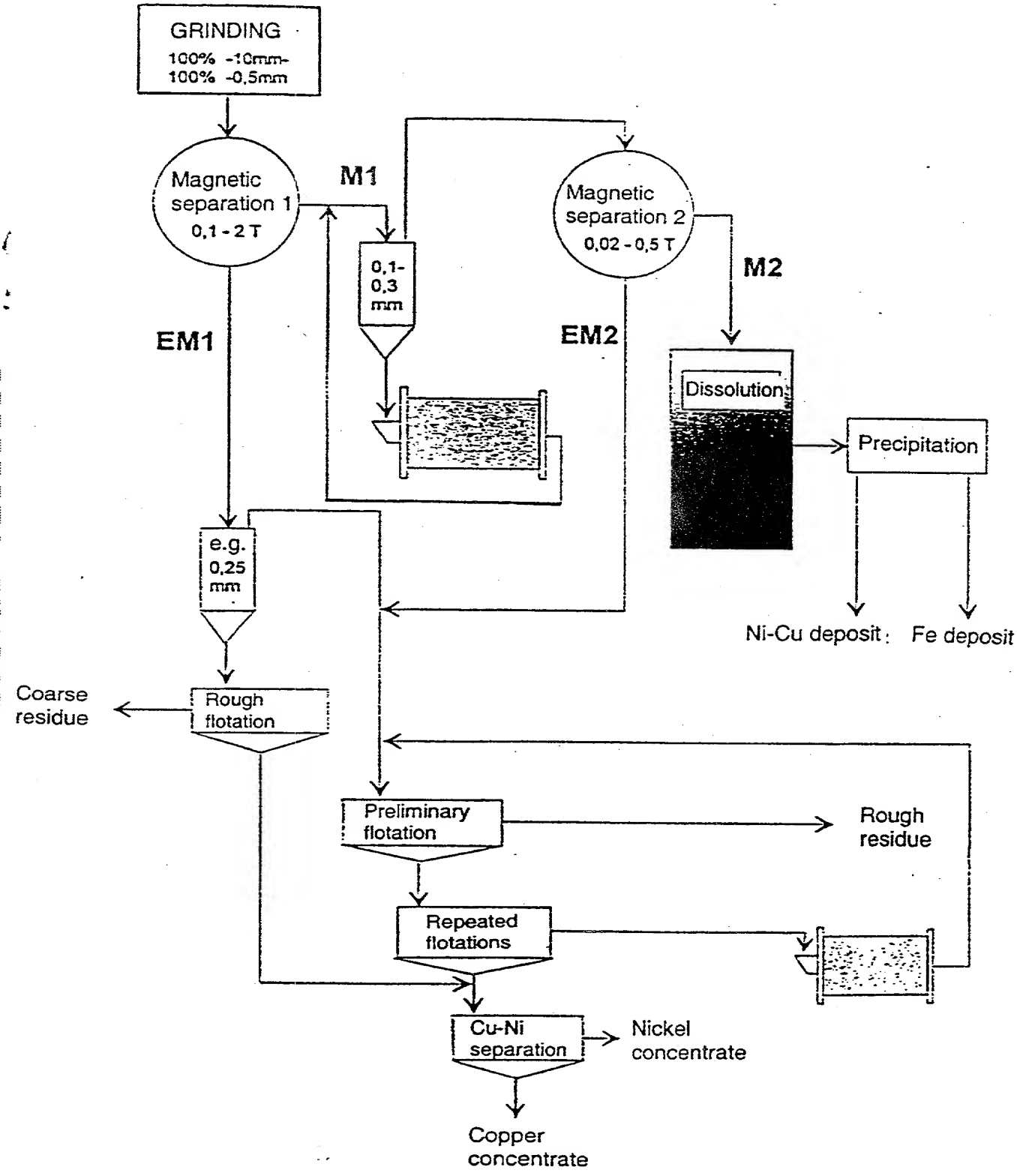
FLOW DIAGRAM OF THE PROCESS OF THE INVENTION



COMBINED DECLARATION AND POWER OF ATTORNEY

(Docket Number)

As a below named inventor, I hereby declare that: 540-004.3

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: ,
- the specification of which is attached hereto unless the following box is checked: ☒. If the box is checked,

  the application was filed on **December 5, 2001**
  as U.S. Application Number **09/980, 951**
  or PCT International Application Number
  and was amended on (if applicable). December 5, 2001

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
FI991294 (Application Number)	**Finland** (Country)	**7 June 1999** (Day/Month/Year Filed)	☐
PCT/FI00/00503 (Application Number)	**International** (Country)	**6 June 2000** (Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

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(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

The undersigned hereby authorizes the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP** to accept and follow instructions from the Finnish firm of **Berggren Oy Ab** as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. firm and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. firm will be so notified by the undersigned.

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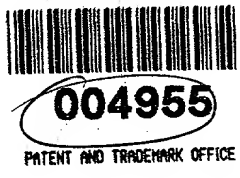

Address all telephone calls to: Ware, Fressola, Van Der Sluys & Adolphson LLP at (203) 261-1234. **Address all correspondence to:**

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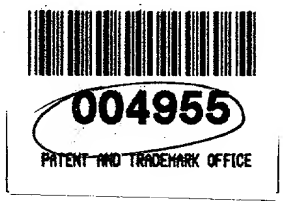

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HÄNNINEN, Esko Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Kerma, Finland Residence	**Finnish** Citizenship
Post Office Address: **Heinävedentie 76, FIN-79910 Kerma, Finland**	

LEPPINEN, Jaakko Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	18 January 2002 Date
Noormarkku, Finland FIX Residence	**Finnish** Citizenship
Post Office Address: **Laviantie 11 A 2, FIN 29600 Noormarkku, Finland**	

HINTIKKA, Väinö Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Outokumpu, Finland Residence	**Finnish** Citizenship
Post Office Address: **Kuparipera 6, FIN-83500 Outokumpu, Finland**	

☐ Additional inventors are being named on separately numbered sheets attached hereto.

COMBINED DECLARATION AND POWER OF ATTORNEY

(Docket Number)

As a below named inventor, I hereby declare that: 540-004.3

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: ,
- the specification of which is attached hereto unless the following box is checked: ☒. If the box is checked,

  the application was filed on **December 5, 2001**
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(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability, as defined in 37 CFR §1.56, which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)

The undersigned hereby authorizes the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP** to accept and follow instructions from the Finnish firm of **Berggren Oy Ab** as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. firm and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. firm will be so notified by the undersigned.

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I hereby appoint the attorney(s) and/or agent(s) assigned to the customer number listed below, as may from time to time be amended, belonging to the U.S. firm of **Ware, Fressola, Van Der Sluys & Adolphson LLP**, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Customer Number

4955

Address all telephone calls to: Ware, Fressola, Van Der Sluys & Adolphson LLP at (203) 261-1234. **Address all correspondence to:**

Customer Number

4955

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

HÄNNINEN, Esko Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Kerma, Finland Residence	**Finnish** Citizenship
Post Office Address: **Heinävedentie 76, FIN-79910 Kerma, Finland**	

LEPPINEN, Jaakko Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Noormarkku, Finland Residence	**Finnish** Citizenship
Post Office Address: **Laviantie 11 A 2, FIN 29600 Noormarkku, Finland**	

HINTIKKA, Väinö Full name of third inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Väinö Hintikka Inventor's Signature	22 January 2002 Date
Outokumpu, Finland FIX Residence	**Finnish** ✓ Citizenship
Post Office Address: **Kupariperä 6, FIN-83500 Outokumpu, Finland**	

3-00

☐ Additional inventors are being named on separately numbered sheets attached hereto.

COMBINED DECLARATION AND POWER OF ATTORNEY

(Docket Number)

As a below named inventor, I hereby declare that: 540-004.3

- my residence, post office address and citizenship are as stated below next to my name;
- I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: ,
- the specification of which is attached hereto unless the following box is checked: ☒. If the box is checked,

  the application was filed on **December 5, 2001**
  as U.S. Application Number **09/980, 951**
  or PCT International Application Number
  and was amended on (if applicable). December 5, 2001

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application			Priority Not Claimed
FI991294 (Application Number)	**Finland** (Country)	**7 June 1999** (Day/Month/Year Filed)	☐
PCT/FI00/00503 (Application Number)	**International** (Country)	**6 June 2000** (Day/Month/Year Filed)	☐

To the extent permitted by rule or law, I hereby incorporate by reference the Prior Foreign Application(s) listed above.

I hereby claim the benefits under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

(Provisional Application Number)	(Day/Month/Year Filed)
(Provisional Application Number)	(Day/Month/Year Filed)

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(Application Number)	(Day/Month/Year Filed)	(Status--patented, pending, abandoned)
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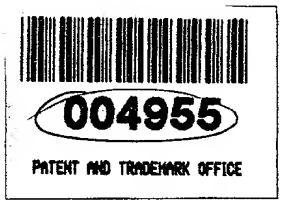

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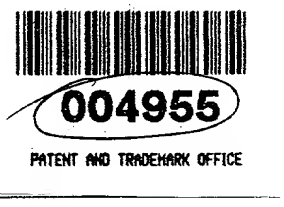

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

HÄNNINEN, Esko Full name of sole or first inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	17 January 2002 Date
Kerma, Finland FIN Residence	**Finnish** Citizenship ✓
Post Office Address: **Heinävedentie 76, FIN-79910 Kerma, Finland**	

LEPPINEN, Jaakko Full name of second inventor (given name, middle initial, FAMILY NAME(S) IN UPPER CASE)	
Inventor's Signature	Date
Noormarkku, Finland Residence	**Finnish** Citizenship
Post Office Address: **Laviantie 11 A 2, FIN 29600 Noormarkku, Finland**	

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